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ABSTRACT

A critical look at two typical research designs is presented, the first study being an investigation of field dependence and reaction time in senior tennis players, and the second being an investigation of the concepts of locus of control and achievement motivation in highly successful male competitive tennis players age 65 and older. A critique of the first study indicates some neglect for determining the reasons for differences in performance. A cognitive functional approach is then presented which is intended to alleviate some of the problems of previous research. This approach emphasizes a careful evaluation of the individual's cognitions prior to, during, and following particular learning and performance situations, and attempts to determine which cognitions are contributing to or interfering with effective learning and maximum performance. References are included. (DS)

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RESEARCH AND FUTURE DIRECTIONS FOR THE STUDY OF MOTOR SKILL ACQUISITION AND PERFORMANCE IN AGING POPULATIONS

Robert J. Rotella and Linda K. Bunker

Recent years have seen a rapid growth of research by sport psychologists and motor learning specialists dealing with elderly individuals. The next decade will most certainly see this trend continue.

As new motor skill acquisition and performance experiences are provided for seniors it is imperative that researchers gain insight into both the present abilities of seniors and future potentials. To understand these differences and design effective developmental methodologies researchers must look for potential weaknesses in current research approaches and look for new and innovative techniques to help them accomplish this task.

A CRITICAL LOOK AT TWO TYPICAL RESEARCH DESIGNS

In order to better understand the need for new investigative tools for studying aging populations, let's review a couple of our earlier studies (Rotella and Bunker, 1978(a); Rotella and Bunker, 1978(b) and then analyze the possible weaknesses of one of them.

The first study investigated field dependence and reaction time in senior tennis players (65 and over). Field-independent subjects are able to attend to significant elements in a visual field (Witkin, et al., 1954, 1962), inhibit irrelevant information (Gardner, 1961), and avoid distraction (Bloomberg, 1965). Also, field-independent subjects are generally more active (Vinicki, et al., 1974), have shown superior ability in accuracy of motor responses (Souder, 1968) and are superior in such tasks as simple reaction time (Barrett and Thornton, 1968) and dynamic non-locomotor balance (Shugart, Souder, and Bunker, 1972).

Reaction time also appears to be affected by one's ability to attend selectively to the particular stimulus to be presented. Because of this, it has been shown to decline significantly with age (Goodenough, 1935; Hodgkins, 1963) and has been used as a diagnostic measure in senility (Ferris, et al., 1976). In addition reaction times for highly skilled athletes have been reported as significantly faster than those of non-athletes (Genasci, 1960; Knapp, 1961).

Because of the relationship between the ability to attend selectively to a simulus and the obvious utilization of selective attention in tennis, the following study was undertaken. Subjects

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were 20 male tennis players (M=72.5 yrs.) who participated in the 1976 national super-senior tennis tournament. Their scores were compared to a non-random control group of 50 volunteer subjects (M=71.8 yrs.) from the Charlottesville community at large. Each subject was tested for field independence utilizing the portable rod-and frame apparatus (Model 1260-AR, Polymetric Co.), which determines each subject's ability to use visual and proprioceptive cues in establishing the upright in two-dimensional space. Each subject was presented a series of 8 rod-and-frame positions, rotated from right to left for 28° deviation, according to standard protocol (Witkin, et al., 1962). Subject's score was the mean of the deviations from 0° on the eight settings of the rod.

Times to respond to a simple light stimulus were determined for each subject on three separate measures utilizing an Athletic Performance Analyzer (Model 631, Dekan Timing Devices): simple reaction time, whole body reaction time, and total body response time. Simple reaction time was measured as the time elapsed between the presentation of a single light (located at eye level, 6 ft. in front of subject) and the depression of a response button held in the subject's preferred hand. Whole body reaction time was the time between stimulus presentation and the subject's lifting of his body weight off a mat. Total body response time was the time consumed from the stimulus signal until the subject had jumped from one mat to a second mat located 3 ft. directly in front of the subject.

TABLE 1

Performance of Groups: Four Measures

Measure	Tennis Players		Control		t	p
	M	SD	M	SD		
Simple Reaction Time(sec.)	.242	.074	.294	.058	3.50	.05
Whole Body Reaction Time (sec.)	.401	.078	.444	.087	1.64	
Total Body Response Time (sec.)	.937	.146	1.168	.269	3.38	.05
Field Independence/Independence (degrees deviation from 0)	2.35	2.02	4.55	1.77	3.64	.05

Performance scores for the three measures of speed of response and field dependence are presented in Table 1. The super-senior tennis players were significantly more field-independent than the control group (t+3.64, p .05). These findings suggest that the tennis players are more able to attend to the significant elements in a

visual field, and these data would also support the findings of Vinicki (1974) who found more active persons to be more field independent.

The tennis players also exhibited faster simple reaction times ($t=3.50$, $p < .05$) and total body response time ($t=3.38$, $p < .05$) than their counterparts. These data also represent faster times for the tennis players than have been previously reported for males of a similar age (Hodgkins, 1963).

The second study was designed to investigate the concepts of locus of control and achievement motivation in highly successful male competitive tennis players, age 65 and over, and in members of the local Retired Seniors Volunteer Program. As new sport programs are developed for the aging it is imperative that the motivations for participation as well as the psychological benefits likely to be a result of such programming be well understood.

Each individual's locus of control may be located on a continuum from internal to external, with internal locations emphasizing the individual's belief that he controls his own destiny. Externals, on the other hand, tend to perceive themselves as victims of fate or chance, with life's outcomes not directly related to skills or abilities. Internals appear to adopt strategies that maximize their perceived control of any situation and tend to accept responsibility for success and failure particularly in environments where the outcome will be largely determined by skill rather than chance, such as sport.

Locus of control beliefs tend to change with age. Children become more internally controlled as they grow older. Young children clearly have little control over their lives, since most decisions are controlled by powerful adults. Beliefs about locus of control become established with increased age as a result of the corresponding development of the ability to care for themselves and affect their surroundings. Phares (1976) argues that elderly populations return to the helplessness of childhood and as a group would be expected to exhibit more external beliefs.

Another potentially significant personality variable of pertinence to the elderly is achievement motivation or the desire to compete against standards of excellence which are to be evaluated by others. Mehrabian (1968) constructed a measure of achievement tendency based on Atkinson's original theory in which low achievers were described as persons who have either relatively low or high levels of aspiration. High achievers prefer situations of intermediate risk, can better delay gratification, and appear more likely to persevere at a task. (Mehrabian and Banks, 1975).

The relationship between achieving tendency and locus of control has generally been found to be inverse and rather low, -.11 to -.22, by Wolk and Ducette (1975) to -.64 by Mehrabian (1968). That is, high achievers tend to perceive themselves as internally controlled and having greater control over external events.

A positive relationship between high achievement motivation and sport performance has also been found (Cratty, 1973; McClelland, 1961; Willis and Bethe, 1970), perhaps because of the potential function of sport participation as a training ground for achievement motivation (Atkinson, 1958).

METHOD

Subjects included 25 males, with a mean age of 67.97 yrs. (13 competitive tennis players and 12 RSVP volunteers). The tennis players had competed in the national "Super-Seniors" tournament in 1976. Each subject was administered the Achieving Tendency Scale for Males (Mehrabian, 1969) and the 23-item Internal-External Locus of Control Scale (Rotter, 1966).

RESULTS

Table 2 provides mean scores of the total group and the two subgroups. These data suggest that in relation to locus of control the total group was generally internal, with competitive tennis players (M=7.07) appearing slightly more internal (M=8.36) than RSVP volunteers, although the difference was not statistically significant (t=1.35, p=.10). These scores also appear more internal than previously reported norms (M=10.02) for younger athletes (Gilliland, 1974).

TABLE 2

Means and Standard Deviations for Two Measures of Motivation

Measure	Total M	Tennis Players (n=13)		RSVP Volunteers (n=12)	
		M	SD	M	SD
Locus of Control	7.71	7.07	2.13	8.36	2.66
Achievement Motivation	9.42	11.29	19.60	7.64	20.27

In terms of achievement motivation, these data indicate a general tendency toward conflict (M=9.42) between the desire to succeed and the fear of failure, i.e. a score of 0 would be complete conflict while + 104 would be totally Ms or Maf. The scores for tennis players (M=11.29) and for RSVP volunteers (M=7.64 compare favorably with the original test (Mehrabian, 1969) norms (M=9,SD=18) and indicate that bothy groups were generally in a state of conflict and that the "Super" tennis players were not significantly different from RSVP volunteers, and certainly not extremely achievement oriented as the original theory might predict.

The Pearson correlation between locus of control and achievement motivation was -.21. This relationship, although very low in value, parallels the previous findings by Wolk and Ducette (1971), which suggested that the more internally controlled persons feel they have greater control over the external environment and also tend to be higher achievers.

DISCUSSION

These findings dispute the pevious argument that elderly individuals would tend to be generally externally controlled (Penk, 1969; Phares, 1976). The seniors in this study tended to be internally controlled and even more internal than younger athletes (Gilliland, 1974).

The successful senior sport participants in this study do not display high achievement motivation scores. This finding refutes the suggestions of many that high achievement motivation is necessary for success in sports.

These results are particularly interesting in relation to the Conflict-Enculturation Theory (Roberts and Sutton-Smith, 1962) which hypothesizes that psychological conflicts induced by social learning in childhood, such as emphasis on achievement training, may later lead to involvement in experessive models, such as game or sport. Through involvement in games, these psychological conflicts are assuaged. As a result, a process of buffered learning occurs which has normative value for specific competencies, i.e. achievement training, required in the culture (Rotella, 1976).

Sutton-Smith, Roberts, and Kozelka (1963) have argued that even in later adult life achievement conflict may be present. This may motivate even senior citizens to be attracted to involvement in expressive models in which the achievement conflict may be at least temporarily reduced. This may be particularly important to elderly males who have been rewarded for achievement throughout life and then suddenly are generally discouraged from achieving in old age. Roberts and Sutton-Smith (1962) argue that it is doubtful that much progressive social learning takes place after biological and cultural maturity. Thus, the game playing is mainly adjustive and may permit adults to continue to be achievement motivated and handle the pressures involved due to periodic experiences at managing success and failure.

The findings of the present sutdy suggest that the conflict enculturation theory is also applicable to senior citizens who continue to be interested in achievement and may remain in a state of approach-avoidance conflict. These adults may be attracted to involvement in various expressive models such as sport or Retired Seniors Volunteer Program. The theory may be useful in understanding why many seniors will still be interested in participating in sports and thus why there is a need for the establishment of such programs for seniors.

A CRITIQUE: THE MISSING INGREDIANTS

Let us begin by taking a closer look at the first study. Certainly valuable and important information has been uncovered. But possibly there was more pertinent information available that was left untouched. In general the "why" and "how" questions remain unanswered.

Why were the super-senior tennis players significantly more field independent than the control group? Why and how were the senior tennis players more able to attend to the significant elements in a visual field? Why and how were these people able to be more active? Why and how were the senior tennis players able to demonstrate faster simple reaction times and total body response times than their counterparts?

Was it possible that the volunteers were uncomfortable with the task and thus failed to understand the instructions? Indeed, the study leaves us short of understanding the reason for the differences in performance between the two groups. Therefore, we are unable to suggest remediations to improve the performance of the group exhibiting deficiant performance. Clearly, researchers are in error if they continue forward without correcting these obvious weaknesses. If changes are not made, seniors will soon grow impatient and not even allow researchers to study them. Subjects of this age often wish to receive some personal gain for their efforts.

A COGNITIVE FUNCTIONAL APPROACH

A cognitive-functional approach to research with the aging may help eliminate some of the problems mentioned above.

A cognitive-functional approach emphasizes a careful evaluation of the individual's cognitions prior to, during, and following particular learning and performance situations. An attempt is made to examine the self-statements and images of the individual in order to determine which cognitions (or the failure to produce which cognitions), under various situational settings are contributing to or interfering with effective learning and maximum performance (Meichenbaum, 1978).

Researchers utilizing a cognitive functional approach concern themselves with (1) the psychological demands of learning or performing various motor skills and (2) the sequentially organized set of cognitive processes that are necessitated for effective learning and/or performance.

The cognitive-functional analyzer conducts an in-depth interview with each individual studied in order to determine what the individual is failing to say to himself, which, if present, would lead to adequate performance and what is the content of the cognitions that interfere with adaptive behavior. The interview should

be formalized, yet flexible enough to allow the sport participant to feel comfortable, open, and honest.

In addition to the interview, researchers utilizing a cognitive-functional approach use several other methodologies for gaining insight into the learning or performance problem. Often the researcher attempts to learn or perform the motor skill in question and then introspects about thoughts, images, and behaviors utilized for effective learning or performance (Rotella, 1979). When successful performance is not possible the researcher may interview other successful participants and have them discuss their thoughts, images, and behaviors.

It does not matter if the researcher alone or the researcher and other participants search for sources of the problem (Rotella, 1978). In either case attention is carefull directed to cues that may indicate the use of particular cognitive strategies.

In either case, attention is mainly focused on the "process" variables. Concern is given to the "why" and "how" of learning and performance. This is quite different from merely attending to outcomes. It does not however suggest that outcomes are unimportant.

The complex nature of many motor tasks and sport skills allows for failure with a variety of cognitive strategies. Learning or performance problems could be due to ineffective task relevant cognitions, task interruptions and distractions, poor strategies for coping with these distractions, a misunderstanding of expectations, and/or a failure to comprehend instructions. Clearly the researcher using a cognitive-functional approach must be a clever and concerned sleuth.

To facilitate the search for the answer to learning and performance problems cognitive functional analyzers have used a variety of traditional and non-traditional techniques (Suinn, 1972(a), 1972(b); Goor and Summerfield, 1975). When traditional assessment instruments to measure anxiety or achievement motivation are utilized they are used differently (Billing, Wakat, Rotella, 1979). Instead of just looking at mean scores and standard deviation the individual is asked "why" responses to certain test items were made. Each individual is also asked the frequency of occurrence of the response. The attempt is to gain a better understanding of the cognitions that are interfering with performance and to ascertain more exactly the occasions on which the problem surfaces.

Often, the individual is placed in the learning or performance situation and encouraged to discuss cognitions occurring during the experience. Frequently, the use of video-tape or guided imagery are utilized to facilitate memory of the pertinent cognitions (Natsoulas, 1970).

In the research study on field-dependence and reaction time the cognitive-functional analyzer would probe for answers to the

following questions. What did you think about when we were explaining the directions of the task to you? Did you worry that you would perform poorly and embarrass yourself? Did you feel anxious? What cognitive strategies did you utilize to perform effectively on each task or didn't you plan a strategy? What did you think about duringperformance of the task? Were you still confused about the directions? Did you fear that if you did we would think that you were senile? Did you wonder if you were wasting your time because you didn't understand the purpose of the study?

Certainly a cognitive-functional approach can give us information which might otherwise be overlooked. But it also has limitations. Researchers using this approach to discover the solution to problems and potentials of the aged must recognize that when sport participants verbalize their thoughts while engaging in a task they may in fact be modifying their thoughts and what they are doing. If researchers can keep this potential weakness in mind cognitive therapy can be quite beneficial and useful to researchers (Mahoney, 1977, 1978; Natsoulas, 1970; Meichenbaum, 1974).

CONCLUSION

The immediate future will undoubtedly produce an abundance of research related to the acquisition and performance of motor skills. Researchers would be wise to include the methodologies of the cognitive functional analyist in their studies. It is a valuable tool which helps in the process of understanding and developing the future potential of the aging.

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